CONSERVATION STATUS AND DISTRIBUTION OF SWAMP FRANCOLIN IN INDIA[1]

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(*With three text-figures*)

Key words: Swamp francolin, *Francolinus gularis*, conservation, *terai*, grasslands, management

The swamp francolin *Francolinus gularis* is distributed in the tall wet grasslands along the Himalayan foothills. Of the 23 localities surveyed in 1988 and 1991 covering the entire *terai* and Brahmaputra flood plains in India, swamp francolin (SF) was confirmed from 12 sites; seven from Uttar Pradesh, one from Bihar and four from Assam. The swamp francolin shows significant preference ($P<0.001$) for different grass associations. *Sclerostachya fusca* and *Saccharum* spp. association is most preferred ($f = 0.82$). Distribution of swamp francolin is affected by the availability of water bodies ($P<0.005$). Swamp francolin sighting is inversely related with linear distance of a waterbody. Livestock grazing is negatively correlated with swamp francolin presence ($P<0.001$). Group size varies from 1-10 and most adults are found in pairs. Bigger flocks constitute parents and chicks. To improve the swamp francolin habitat, plantations in the grassland should be stopped and prescribed burning should be done in January or first half of February.

INTRODUCTION

The swamp francolin *Francolinus gularis*, distributed along the Himalayan foothills in tall, wet grasslands of the *terai* and the Brahmaputra flood plains, is endemic to the Indian subcontinent (Ali and Ripley 1987). It occurs in a few areas in Nepal (Inskipp and Inskipp 1991) but has probably completely disappeared in Bangladesh, as Harvey (1990) had no sighting, but felt that it might still occur in small numbers. Ali and Ripley (1987) described its exceptional occurrence in the Cherrapunji plateau (1200 m above msl).

Very little work has been done on the status and biology of the swamp francolin, except for brief surveys by Kaul and Kalsi (1990) and Javed and Rahmani (1991). A study was also conducted in Dudwa National Park to develop a suitable survey technique for swamp francolin census (McGowan *et al.* 1995). Based on these preliminary studies, a more detailed study on the habitat use of swamp francolin was conducted just outside Dudwa National Park (Iqubal *et al.* 1995). A preliminary study on the diet and activity pattern of swamp francolin was conducted in Nepal (Shreshta 1992).

The swamp francolin is a threatened species (Collar *et al.* 1994) and is considered vulnerable to extinction under the Mace-Lande (1991) threat criteria, because of the threat to its tall grass habitat. Widespread reclamation, and poaching, to some extent, have adversely affected swamp francolin distribution.

The aim of our study was to find out the factors affecting distribution patterns of swamp francolin and to evaluate the present conservation problems in protected and unprotected areas.

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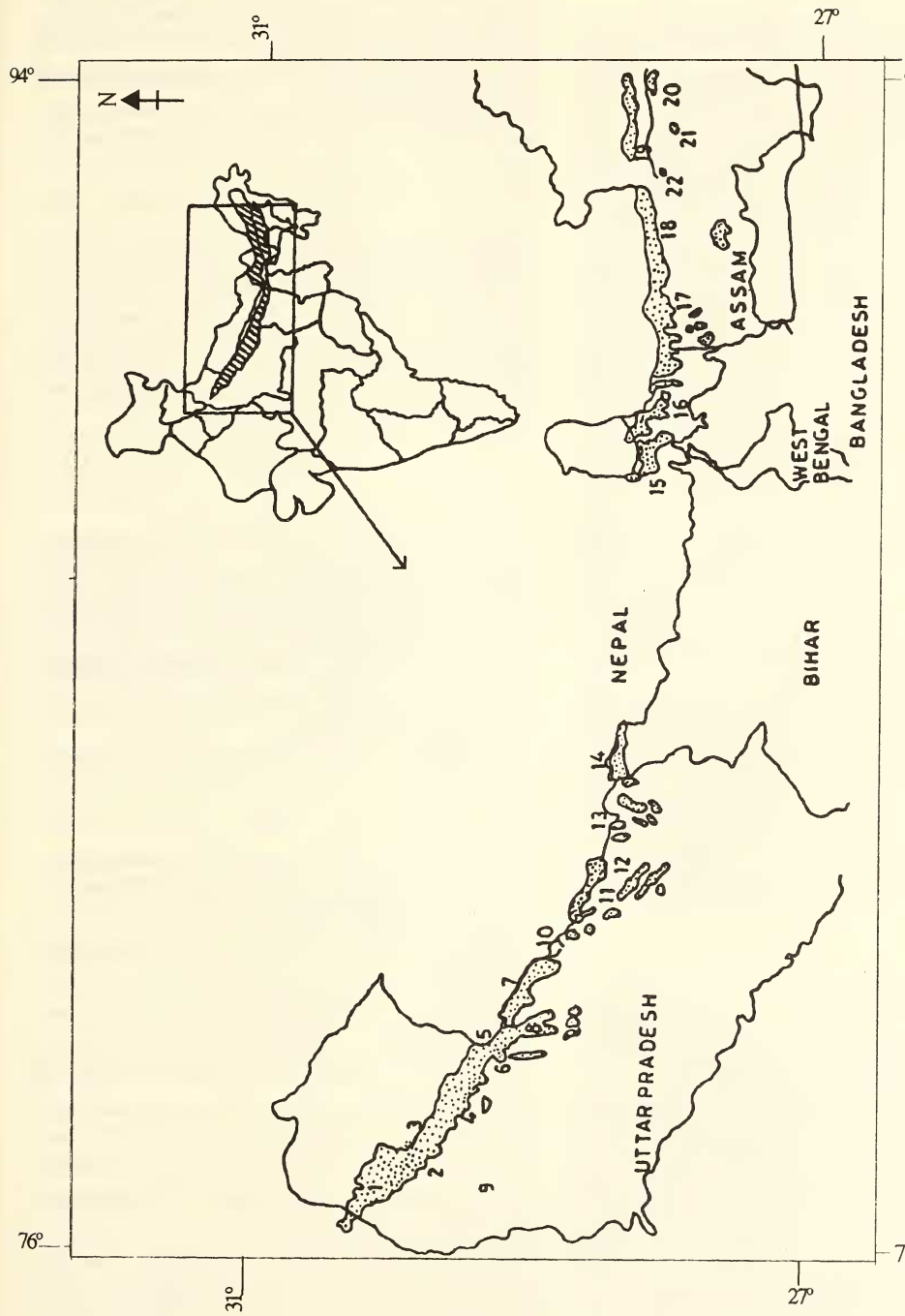

Fig. 1: Swamp francolin survey sites in India. 1. Rajaji National Park, 2. Lansdowne, 3. Hastinapur Sanctuary, 4. Corbett National Park, 5. Haldwani Division, 6. N. Pilibhit Division, 7. Lagga-bagga Reserve Forest, 8. Dudwa National Park, 9. Kishanpur Sanctuary, 10. Katarnia-ghat Sanctuary, 11. Suhelwa Sanctuary, 12. Sohagi Barua Sanctuary, 13. N. Gorakhpur Division, 14. Valmikinagar Tiger Reserve, 15. Jaldapara Sanctuary, 16. Manas Tiger Reserve, 17. Bornadi Sanctuary, 18. Sonai Rupai Sanctuary, 19. Kaziranga National Park, 20. Laokhowa Sanctuary, 21. Orang Sanctuary, 22. Pobitara Sanctuary (see Table 2)

Study Area

TERAI

Terai region is a flat stretch of alluvial land between the Himalayan foothills and the Gangetic plain. It extends through Uttar Pradesh, parts of Bihar, northwest Bengal, Assam and Nepal. It is characterised by soil which is clayey, boulderless and with high moisture content. The high water table and annual precipitation from 1000 to 1800 mm per annum play an important role in determining the characteristic vegetation of the whole region. The vegetation is of the moist deciduous type, dominated by extensive patches of sal *Shorea robusta* forest, interspersed with grasslands dominated by *Saccharum, Typha, Narenga* and *Sclerostachya* species.

Till the early 1950's the whole *terai* region was very thinly populated except for the tribal *tharus* who inhabited the area. The north Indian *terai*, which once covered 12 districts of Uttar Pradesh, is now restricted to the districts of Pilibhit, Lakhimpur-Kheri, Bahraich, Gonda and Gorakhpur, covering an area of about 6500 sq. km. The uncontrolled expansion of agriculture, current land-use pattern and other biotic and abiotic factors have reduced the once extensive *terai* into small fragments (Fig. 1). As a result, what exists today is in protected areas such as national parks and sanctuaries amidst a sea of cropland and human settlements under high biotic pressure.

DUDWA NATIONAL PARK

Dudwa National Park is situated on the Indo-Nepal border in Nigahasan tehsil of Lakhimpur-Kheri dist., Uttar Pradesh. The area falls under the Terai-Bhabar biogeographic subdivision of the Upper Gangetic Plain (7A) according to the classification of Rodgers and Panwar (1988). The Park lies between 28° 18' and 28° 42' N lat., and between 80° 28' and 80° 27' E long. The Himalayan foothills lie about 30 km to the north of the Park. The Suheli river on the southern side and the Mohana river on the north form the natural boundaries of the Park. The topography is flat, with a maximum elevation of 182 m above msl. To protect the relict population of swamp deer *Cervus duvaucelli* in particular, an area of 212 km² was declared as a Sanctuary. In 1977, the area was declared as a National Park with a core zone of 490 sq. km and a buffer zone of 124 km². The buffer zone in Dudwa National Park (DNP) is located to the north of the core zone and includes *tharu* tribal villages. About 30,000 people continue to live in a stretch of land approximately 5 km wide in and around the Park (Singh 1982). They are partly dependent on the forest for thatching, fodder and fuel wood, thus creating an important management issue (Javed 1996).

Methods

Surveys were conducted in Uttar Pradesh, Bihar, West Bengal and Assam in 1988, while in 1991 only the former two states were surveyed. We surveyed all the protected forests and sizable patches (3-5 sq. km) of conservation importance in the entire north Indian *terai* belt and the Brahmaputra flood plains.

Data on habitat preference and factors affecting the distribution of swamp francolin were collected from 1988 to 1994 in Dudwa National Park. On the basis of reconnaissance surveys, a few locations were selected for random transects. Casual sightings of swamp francolin were also included. Variables recorded for each francolin observed were vegetation associations, phenophase, cover value, distance of water source (linear distance), disturbance factors such as cattle grazing, grass cutting, plantation (year of plantation, extent and success of plantation), fire, draining of wetlands and encroachment. Vehicular census was done along motorable paths. At intensive study sites i.e. Sathiana (40 sq. km) and Kakraha (24.5 sq. km) in Dudwa, permanent transects of varying length from 1 to 2 km were laid in different vegetation types. Parameters recorded were the same as discussed in the survey methods, except that in the intensive

study areas the effects of fire and flood were also studied. To record the effect of burning, animals flushed from burning sites and areas utilized at the time of burning were noted. During floods, observations were made from elephant back in different grassland types.

Analyses

Actual sightings and calls were considered for analysis. Each call heard was considered as a sighting record. Care was taken to avoid duplication of calls/sighting. Dudwa grasslands are divided into four broad categories (Qureshi *et al.* 1990), (a) Tall wet grassland, (b) Short grassland (c) Moist savanna and (d) Derived grassland due to anthropogenic factors (Table 1). Ten associations were identified in these categories (Qureshi *et al.* 1990). To calculate habitat preference, we clumped the associations into three groups, depending on the dominant grass species. Group I - *Phragmites karka, Arundo donax, Sclerostachya fusca, Saccharum* spp. (except *S. munja*), *Themeda arundinacea* and *Narenga porphyrocoma*. Group II - *Imperata cylindrica*, *Vetiveria zizanoides, Desmostachya bipinnata* and *Eulaliopsis binata*. Group III - *Saccharum munja, Cymbopogon martini* and *Imperata cylindrica* (drier type).

Table 1

FREQUENCY OF DIFFERENT HABITAT TYPES IN INTENSIVE STUDY AREA (SATHIANA AND KAKRAHA) IN DUDWA NATIONAL PARK

Habitat Type	Percentage frequency occurrence of habits	Percentage area in the park (490 sq. km.)
Sal woodland	10	54.09
Moist Mixed Forest	7	6.85
Riparian Forest	5	5.99
Tall Wet Grassland	25	18.41
Derived Grassland	20	-
Moist Savanna	18	3.44
Wetland	5	2.98
Woodland grassland edge	10	-
Other woodland areas including plantation		8.83

Table 2

SWAMP FRANCOLIN SURVEY SITES

Locations	Area (sq. km.)	Swamp francolin records	Disturbance Level
Uttar Pradesh			
Rajaji National Park	824	-	2
Lansdowne	604	-	3
Hastinapur Sanctuary	1280	-	3
Corbett National Park	384	-	0
Haldwani Division	1140	?	2
N. Pilibhit Division	550	+	2
Lagga-bagga Reserve Forest	11	+	3
Dudwa National Park	614	+	0
Kishanpur Sanctuary	277	+	1
Katarnia-ghat Sanctuary	400	+	2
Suhelwa Sanctuary	450	-	2
Sohagi Barua Sanctuary	428	+	2
N. Gorakhpur Division	-	+	2
Bihar			
Valmikinagar Tiger Reserve	462	+	2
West Bengal			
Jaldapara Sanctuary	118	?	2
Assam			
Manas Tiger Reserve	391	+	1
Bornadi Sanctuary	26	?	2
Sonai Rupai Sanctuary	175	?	3
Kaziranga National Park	430	+	1
Laokhowa Sanctuary	70	+	3
Orang Sanctuary	75	+	2
Pobitara Sanctuary	16	+	2

Disturbance level: 1 = Low, 2 = Medium, 3 = High

Chi-square test (with correction for continuity), Null hypothesis tested by the Chi-square test (Alleredge and Ratti 1986) based on data on availability and utilization of habitat, Kolmogrov-Smirov goodness of fit test, Fisher exact test, and Phi (Cramer's) coefficient (Zar 1984) were used for testing the significance of swamp francolin association with different grass associations, effect of cattle grazing and distance of francolins from water source.

RESULTS

Status Survey

Twenty-two localities were surveyed, and we found evidence of swamp francolin at 13 sites (Fig. 1, Table 2). With its presence in all well protected grasslands and its wide range of occurrence, this species seems to exist in far greater numbers than supposed earlier. The status of swamp francolin is comparatively good in Uttar Pradesh and Assam, while in Bihar it occurs only in Valmikinagar Tiger Reserve. Its presence in West Bengal is doubtful (Table 2). We did not see any swamp francolin during our visit to Jaldapara Sanctuary, although its presence is not unlikely there. Table 3 shows sighting of swamp francolin in and around Dudwa National Park between January 1991 and 1992.

Habitat use pattern

Broad habitat categories like tall, medium and short grasslands did not show significant correlation ($\chi^2 = 2.56$, $P>0.05$) with sightings of swamp francolin. Swamp francolin showed a

TABLE 3

SIGHTING OF SWAMP FRANCOLIN IN AND AROUND DUDWA NATIONAL PARK (JANUARY TO JUNE 1993)

	Locality	Adult	Chicks	Call
1.	Kakraha	2	5	+
2.	Chedia Taal	2	8	+
3.	Amaha	2	-	+
4.	Kurmania	2	-	+
5.	Base Camp	2	-	-
6.	Satiana FRH	1	3	+
7.	Partridge Cottage	-	-	+
8.	Chapra	2	6	+
9.	Kowwhaghati Bridge	-	-	+
10.	Makhan-bhouji	2	-	+
11.	Madriya	2,2,2	-	+
12.	Gajraula	2	3	+
13.	Qila	2	-	+
14.	Bhadi Taal	-	-	+
15	Atarnagar	1	2	-
16.	Ainthpur	1	-	-

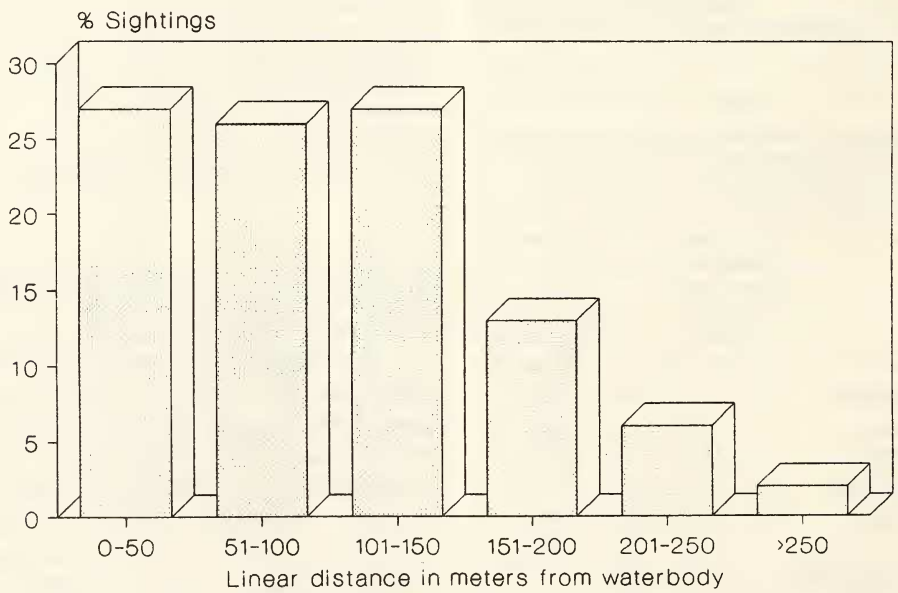

Fig. 2: Distribution of Swamp francolin at water bodies

significant preference for different associations of three groups of grass species (n = 50, dmax = 29.3, P<<0.001). The maximum association was with group I species (f = 0.82) of which *Sclerostachya fusca* and *Saccharum* spp. associations were utilized more. Group II species (f = -0.19) and group III species (f = 0.19) showed no correlation. The distribution of swamp francolin is further limited by distribution of water sources. Significant correlation (n = 48, dmax = 12, p<<0.005) was observed between swamp francolin sightings and linear distance of the water body. The majority of sightings occurred within 200 m of the water source (Fig. 2). Cattle grazing adversely affects swamp francolin; they withstand light grazing, but avoid medium to heavily grazed grassland patches (f = 0.90, P<<0.001, Fisher exact test). The sample size constrained to test the differential use of burnt and unburnt patches. At the time of burning, the swamp francolins took refuge in unburnt patches. Within a week after the burning, they were randomly distributed in burnt and unburnt patches. Burnt patches bordering unburnt grass patches were used more. During the peak flood period, swamp francolin take refuge in derived (highland) grassland occupied by group III species.

Group size

Swamp francolin group size varies from 1 to 10 (Fig. 3). The majority of sightings of adults (52%, n = 29) were in pairs. Four was the maximum group size in adults. Bigger groups constituted a pair with chicks. On an average, five chicks per pair or per mother (range of group size 2-8) were observed.

Discussion

Large-scale encroachment of grassland, plantation of commercially important trees such as *Eucalyptus, Dalbergia sissoo* and *Bombax ceiba*, and fragmentation of grassland are major threats to the future of swamp francolin. Table 2 indicates the level of anthropogenic disturbance in different areas. Swamp francolins are associated with tall wet grasslands (Ali and Ripley 1987). The group I species (*Phragmites, Arundo, Sclerostachya, Saccharum, Themeda* and *Narenga)* are distributed in seasonally inundated areas or near seasonal or perennial

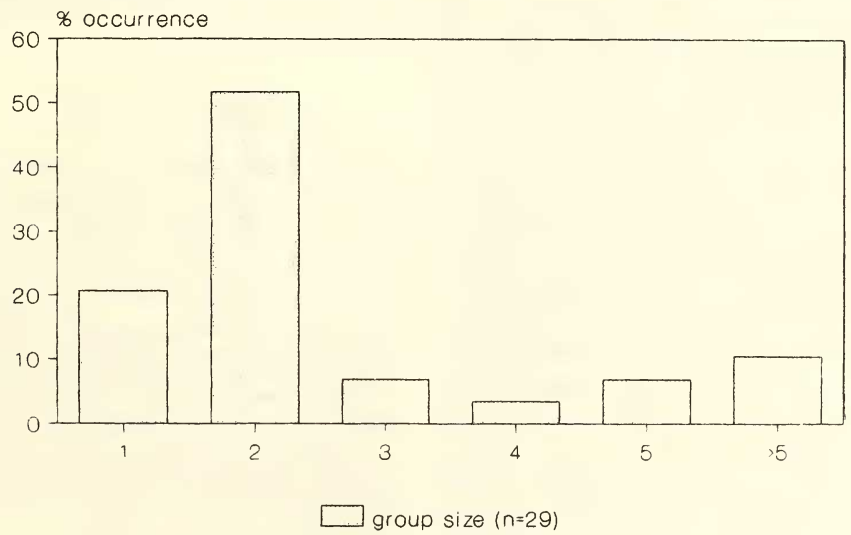

Fig. 3: Distribution of Swamp francolin in different group sizes

streams. Group I associations are preferred by swamp francolin for nesting, cover and for food. Seasonal trends of association use are not evident from our data. Nesting generally occurs on broken down grass stalks or near a waterbody on grass beds (Ali and Ripley 1987).

Cattle grazing has a negative effect on the use of an area by swamp francolin. Heavily grazed areas are avoided due to decrease in the density of the vegetation cover, while light grazing seems to have no effect. Species occupying habitat with dense vegetation cover are likely to be most sensitive to herbage removal (Sedgwick and Knopf 1987). Grazing pressure is generally high in summer, when post-burn nutritive grasses are available and water availability is limited.

The grasslands of the *terai* are burned from December to April in large areas varying from 1-5 sq. km. At the time of burning, the swamp francolin takes refuge in unburnt grass patches, generally near waterbodies or areas safe from fire. The nesting time of swamp francolin in the north Indian *terai* is during February-April. Thus it is suggested that grasslands should be burned in January and the first half of February, when burning will not have any adverse effect on nesting, and also provide sufficient cover. The mosaic of burnt and unburnt patches will provide sufficient feeding areas. It seems that sudden changes in grassland structure due to burning may have an effect on ranging pattern, but this needs further study. Within a week of burning, the birds were seen utilizing burnt patches. Rank grass patches not burnt for 2 to 3 or more years, forming thick tangles of dead and live material, are avoided by swamp francolins. Studies on grey-winged and red-winged francolins in South Africa indicate that burnt grass patches were preferred by these francolins (Mentis and Begalke 1979). It seems that fire did not have any negative effect on nesting success, as adequate nesting habitat was available in the form of unburnt patches. Sightings of chicks in all the years except 1990 support our view. The reason for the decline in chick survival rate is not understood, and the effect of fire on nesting success and chick survival needs further investigation.

Sightings of swamp francolin in agriculture dominated areas are centred around sugarcane (*Saccharum officinarum*) and paddy (*Oryza sativa*) interspersed with waterbodies (marshes) of various sizes having natural vegetation. All sightings in croplands occurred within 200 metres of marshes having associates of group I species. The croplands are also shared by the black (*F. francolinus*) and grey (*F. pondicerianus*) francolins.

In its entire range of distribution, large-scale conversion of grassland for agriculture and plantation render most of the area unsuitable for swamp francolins. Plantation in grassland should be stopped and encroachment on grassland in protected and unprotected areas should be checked. Cattle grazing should be minimized as per the local situation and grassland should be burned at the end of February or in the first half of February, leaving some patches unburnt, thus creating a mosaic of burnt and unburnt patches to facilitate nesting.

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